Remarks

Claims 1 - 15 are pending. Claim 5 has been amended. Reconsideration is respectfully requested.

Applicants apologize for the errors in claim 5 which were made while rewriting the claims into U.S. format, and which necessitated the rejections under 35 U.S.C. § 112. The language "C_1 to C_3" has been amended to be consistent with the other "C_x" language by replacing, in each instance, with the equivalent language "C_{1-3}". The spurious "12" in line 7 has been deleted, as has the spurious "R_3". The word "be" following "optionally" in line 7 has been deleted. In line 14, the phrase "substituted by further heterocycles" has been amended to recite "containing further heteroatoms" and the heteroactoms are identified as those recited on page 5, lines 15 - 18. The term "heterocycles" in line 16 of page 5 of the specification has been replaced by "heteroatoms", which was clearly meant, and is consistent with U.S. usage.

The Office has questioned the meaning of "is interrupted by an O or N atom" in line 12. this language is universally employed by those skilled in the art to refer to organic compounds which contain O or N atoms interspersed in an otherwise carbon chain. For example, a hexylene (all carbon) group which is interrupted by O or N would include such compounds as $-(CH_2)_2-O-(CH_2)_4-$, $-[(CH_2)_2-O-]_3$, and $-(CH_2)_3-NH-(CH_2)_3-$. The claims are addressed to one of ordinary skill in the art who is well aware of this usage.

Withdrawal of the objection to claim 5 and the rejections of claims 5 and 11 under 35 U.S.C. § 112 ¶2 is respectfully solicited.

Claims 1 - 4 and 6 have been rejected under 35 U.S.C. § 102(b) over Tschirner et al. U.S. 6,211,289 ("*Tschirner*"). Applicants respectfully traverse this rejection.

The application is directed to silane-modified polyvinyl alcohol polymers having a degree of hydrolysis of from 75 to 100 mol%. In the past, silicon-containing polyvinyl alcohol polymers, which are highly useful in paper coating applications, exhibited insufficient storage time in aqueous solutions in which they are employed. As shown in Comparative Example 1, prior art products exhibit a high increase in viscosity upon storage, the polymer of Comparative Example 1 being four times that as prepared, after 14 days at room temperature, whereas the polymer of the present invention exhibited virtually no change in viscosity over the same time period.

Polyvinyl alcohol polymers cannot be prepared by polymerizing vinyl alcohol, which does not exist, but rather are prepared by polymerizing a vinyl ester, almost always vinyl acetate, followed by hydrolysis of the pendant acetate groups to hydroxyl groups. The presently claimed polymers also contain moieties derived from 0.01 to 10 mol percent of silane-containing unsaturated comonomers such as vinyltriethyoxysilane. The vinyl ester from which the polyvinyl alcohol is derived must, however, contain from 1 to 30 mol percent of one or more 1-alkylvinyl esters of C_{1-6} carboxylic acids, for example 1-methylvinylacetate. The presence of the latter, which adds pendant methyl groups to the polyvinylalcohol chain, is responsible for the surprising and unexpected storage properties.

Tschirner is not directed to polyvinyl alcohol polymers, but to polyvinyl acetal polymers. Polyvinyl acetals are produced by hydrolyzing a polyvinylester polymer to polyvinyl alcohol followed by converting the hydroxyl groups of the polymer to acetal linkages by reaction with an aldehyde such as acetaldehyde. For instance, in Examples 1 and 2, acetalization is effected with butryaldehyde, forming a polyvinylbutyral polymer. Thus, the basic polymers of *Tschirner* are polyvinyl acetals, not polyvinyl alcohols.

In column 11, *Tschirner* discloses an analytical method for calculating the molecular weight of the non-acetalized polyvinylalcohol intermediate product by size exclusion chromatography (SEC). In order for this method to work, the polymer must not interact with the solvent (diluent). However, hydroxyl groups interact very effectively with water, the

usually preferred solvent, and thus a non-polar organic solvent must be used. Polyvinyl alcohols (PVOH) are not soluble in such solvents, however, so the PVOH polymers are silylated at the hydroxyl group by reacting with bistrimethylsilylacetamide, a saturated silane, which transforms the polar and hydrophilic pendant hydroxyl groups (-OH) to -O-Si$(CH_3)_3$ groups. As can be seen, the trimethylsilyl groups are bonded to oxygen by an O-Si linkage.

By contrast, the subject invention produces silane-modified polyvinyl alcohols by copolymerizing an unsaturated silane, which produces a polymer with a carbon chain having (following hydrolysis) pendant hydroxyl and pendant C-Si bonded silane groups. There are no -O-Si bonded silyl groups as in *Tschirner*. It should also be noted that the compound of *Tschirner* is not a silane, since there are no reactive groups attached to silicon, which silanes require. In the *Tschirner* compound, the silicon atom bears three unreactive methyl groups.

Tschirner does not disclose the polymers of the present invention, nor does he teach or suggest therm. Withdrawal of the rejection of the claims over *Tschirner* is solicited.

Claims 1 - 15 have been rejected over Schilling et al. U.S. Patent 4,879,336 ("*Schilling*") in view of Maruyama et al. U.S. 4,617,239 ("*Maruyama*"), under 35 U.S.C. § 103(a). Applicants respectfully traverse this rejection.

Schilling is directed to the use of fully saponified polyvinyl alcohol copolymers in coating slips. The art was aware that in such applications, fully saponified (98-100 mol% vinyl alcohol groups) PVOH is far superior to partially saponified PVOH, which still contains 10 - 30% vinyl acetate groups (70 - 90% saponified). However, fully saponified PVOH is very difficult to dissolve in water, even at fairly low concentrations, making special "dissolving stations" mandatory. See *Schilling* at column 2, lines 7 - 24.

To overcome these deficiencies, *Schilling* incorporated 1-alkylvinyl alcohol moieties into his polymer. As a result, the polymer could still be fully saponified yet remain

soluble. As comonomers, *Schilling* prefers vinyl acetate and allylalcohol, when comonomers are used.

Maruyama discloses polyvinyl alcohols which contain silane moieties. The copolymer of Comparative Example 1 of the subject invention is the same type of product taught by *Maruyama*, and this product was found to be unstable in solution, as illustrated in Table 3 on page 13 of the application.

Schilling is but one of numerous patents directed to preparation and use of PVOH polymers. While *Schilling* does allow for additional comonomers to be polymerized, in the range of 0-5% by weight, he sheds no light on what type of comonomers should be used. *Schilling* prefers his polymers to contain (c) and (d) comonomers, derived from non-saponified vinyl acetate and allylalcohol, respectfully. *Schilling* does not even mention unsaturated silanes, as far as Applicants are aware.

The problem solved by Applicants is to avoid the premature gellation of *Maruyama*-type products. There is no teaching or suggestion in either of the references that this problem might be solved by incorporating a minor quantity of 1-alkylvinyl groups into the polymer, nor is there any known scientific basis for the surprising and unexpected results obtained. The increase of solution viscosity of Applicants' polymers is extremely low, while that of *Maruyama*'s is quite high. In Table 3, Applicants' solution viscosity increased by only 0.7%, while a polymer as taught by *Maruyama* increased by 260%!!

Applicants do not find any motivation to combine *Schilling with Maruyama.* As indicated in *In re Schaffer,* 108 USPQ 326 (CCPA 1956), a reference which does not discuss the problem solved by Applicants (premature gelation) cannot suggest a solution, and cannot render an invention obvious. However here, even were there motivation to combine these references, one skilled in the art would expect that a silane-modified polymer of *Schilling* would exhibit the same gelation and storage stability problems as those of *Maruyama.* Surprisingly, this is not the case. The effects, as demonstrated in Table 3, are quite dramatic.

The claimed invention is clearly non-obvious over the combination of *Schilling* and *Maruyama*. Withdrawal of the rejection is therefore solicited.

Applicants submit that the claims are now in condition for Allowance, and respectfully request a Notice to that effect. If the Examiner believes that further discussion will advance the prosecution of the Application, the Examiner is highly encouraged to telephone Applicants' attorney at the number given below.

Respectfully submitted,

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